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AACE BULLETIN

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Vapor Pressure of Money

Time Value of Money

BULLETIN

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Notes from the Editor

If you were fortunate in being able to attend the Annual Meeting in Houston; I know that you benefited from the opportunity to discuss mutual problems and probably went home with some possible solutions to those problems.

One of the frequent questions that we are asked by people who are preparing an article or compiling cost data is: "If my article is published in the *AACE Bulletin* will this eliminate it from consideration by one of the commercial publications?" I am happy to say that this is not the case. Since the AACE has a select membership, its publications do not reach the circulation enjoyed by the commercial journals. Therefore, publication in your professional association's *Bulletin* enhances the chances of having your paper considered by other journals. In fact, our Publications Committee will assist you in making such arrangements. I would welcome the privilege of considering, for publication in the *Bulletin*, the results of your experience, as well as any cost data that you would be willing to make available. Incidentally, I should note that this publication, the *AACE Bulletin*, is the only official journal of our Association. We are not affiliated with any other publications, even though we are pleased to include among our members representatives of other journals.

Enclosed with this *Bulletin* is the current AACE information pamphlet. You can help build your Association by seeing that this information gets into the hands of someone qualified for membership. I will be happy to send an application and additional copies of the pamphlet to whomever you recommend.

Don't forget the copy deadline for the next issue of the *Bulletin* — **August 5!**

COVER: *"Probability". Courtesy of The Sperry Gyroscope Company, Division of Sperry Rand Corporation.*

Message from the President

Dr. Bernard J. Gaffney
Wood Conversion Company
President of AACE

Tempus fugit. The June meeting will be here before one knows it. The reports this office has been getting are most encouraging, even permitted a normal dosage of salt.

First thing at the meeting Monday morning will be a summary of committee reports. I can assure the membership that the various committee-men have been on real active duty — I cannot assure that their communications to me will arrive on time. Being an old cross-country runner, they are put on notice that reports must get in on time. Otherwise I shall be forced to chase them to Boston Common and like the frogs in the pond they are apt to go, "croak, croak."

I have heard little on how well our organizational manual is shaping up. Messrs. Gorey and Agarwal certainly started out in high steam, and the manual is a must for efficient organization and administration.

Our new Regional Section Chairman, Mr. Wes Dodge, is by all accounts doing a terrific job. His legible writing and well-organized letters and the interest and cooperation he has stirred up — well it is wonderful to have a man like that associated with us. Look forward especially to his report.

Sometimes there are people who do a lot for us whose names do not often get into print and do not want their names in print. Sometimes jobs are taken to be far less difficult than they are. This Cost Index Manual is a point in case. There have been some stumbling blocks. I suppose the first publication try of anything is less than perfect. The manual will certainly serve a useful purpose, and the final editing was quite a chore, notwithstanding efforts by others in collating data and in designing binders. Over and above our publication standards that are now being formulated, perhaps there is a need for one on manuals. Sometimes it is better to learn to walk before one runs.

Have received an advance copy of a paper, "Research for Cost Engineering," to be presented at our annual meeting. It certainly is a well-written article and with an approach much to my way of thinking. There are divisions of interest in our membership, as there are in all memberships, as to what problems should be tackled first. There are those who want to know others everyday experiences and present practices. Basis of interest might be termed early return. There are those who want to know what are the fundamental bases of cost engineering operations. Research and development are needed. Time is required. Without this kind of activity the growth of cost engineering cannot be assured. There is thus a place for both. It is gratifying to see some sound thinking on the latter. At the meeting there is a good division of presentations for both the short and the long term aspects.

The matter of obtaining E.J.C. membership was given attention by this office and was transferred to the office of the Executive Secretary upon advice of counsel. Actions have been taken to forward this matter, and a report will be available at the June meeting.

There have been some problems with chairmen of committees going off to Chile and like situations. But the sponsors and regions have been playing a good role in keeping a number of matters going while new chairmen are obtained. It is a good thing that chairmen do not receive remuneration for their services. If they ever caught on to how important they are, there would be a strike for wage increases.

At the breakfast for the regional section officers there should be a brief but adequate chance to air important regional matters. This should prove of real benefit to the membership. Have received a majority of acceptance replies to date.

On May 16 I am going to attend the Chicago Regional Meeting, and am scheduled for a meeting in Pittsburgh on October 12. As you see from my last letter, I mean what I say, and I say what I mean. Anyhow, am making a good try and would be glad to hear from other regions.

You might have noticed from your program of our annual meeting that I am to be your toastmaster at the banquet. This dubious honor was not intended for me, and there has been a slip. After the Cleveland meeting it is doubtful you could stand that again. However, philosophically, whatever will be, will be. In any event do not let me scare you away from the meeting.

(Continued on page 30)

The Vapor Pressure of Money

Cecil H. Chilton, McGraw-Hill Publishing Co., New York, New York

SOON AFTER he arrived in Pittsburgh, Dr. Ernst Berl, the eminent German chemical engineer, was shown the newly built facilities of Mellon Institute. So impressed was he with this imposing edifice that he commented, so the story goes: "Ach, mein Gott, der wapor pressure uff money!"

Perhaps Berl was thinking of one definition of vapor pressure of a substance in which the property is called an "escaping tendency." In any case, his use of the term "wapor pressure" suggests the idea that money ranks alongside matter, energy and time as a fundamental engineering quantity.

In several respects, I will admit, money does not qualify as an engineering unit.

- All other engineering units are defined precisely.
- They remain essentially constant from year to year.
- Engineering units can be translated exactly into comparable foreign units which are themselves precisely defined.

Even though the dollar cannot be precisely defined, does not remain constant from year to year and cannot be converted accurately into foreign units, it is still a useful and essential engineering unit.

Thermodynamics and Kinetics

Sticking with analogies, let's consider briefly the *thermodynamics* of money.

Thermodynamics is the study of a system at equilibrium. Studies in economic balance, therefore, might be called the thermodynamics of money. This area has been a classical field of study for the engineer. Back in school we all had to solve problems in economic balance: optimum reflux ratio in a distillation column, optimum thickness of insulation for a steam line, etc.

Going a step further, consider the *kinetics* of money. Operation of a chemical company, or any other economic enterprise, is a rate process. If there is no net flow of money, we are in a state of thermodynamic equilibrium — something is wrong with the business.

As most engineers know, a rate process can be expressed mathematically as a coefficient times a driving force divided by a resistance.

$$R = Y(S - E)/I$$

In this equation, S is money coming into the business from sale of goods and services over a certain period; E is money paid out for materials, labor, taxes and all other expenses over the same period; I is money invested in the business in permanent facilities and working capital; Y is a "risk factor;" R is return on investment, expressed as a fraction or decimal based on the given period. The quantity $(S - E)$ is the driving force, I is the resistance, Y is the coefficient and R is the transfer rate.

When this relationship reports historical data, such as performance of the business for the past year, S, E and I are firm figures, Y is 1.0 and return on investment R is calculated as a definite value. For any future period, however, where S, E and I must be estimated, Y represents the probability that return R will be realized. Of course, Y should be closer to 1.0 for an established business than for a proposed venture.

Consider an Example

Suppose you have a shell-and-tube heat exchanger in which steel tubes must soon be replaced because of corrosion. Should you replace with more steel tubes, or should you retube with some other material — aluminum, brass or stainless steel, say.

Assume that cost of retubing with steel is $1,200, with aluminum is $1,800, with brass is $2,000, and with stainless is $2,800. Steel is the cheapest material to use, but even a student will say that's only *part* of the answer. "It's cost per year that counts."

So we can expand our cost analysis to include estimated tube life and annual cost.

Material	Retubing Cost	Tube Life	Annual Cost
Steel	$1,200	2 yr.	$600/yr.
Aluminum	1,800	6	300
Brass	2,000	4	500
Stainless	2,800	10	280

Stainless steel is the most economical material to use in terms of annual cost. This answer — the thermodynamic, or economic balance, answer — will be accepted by many engineers without question. But what would be the answer on a kinetic basis? Remember, in our rate equation the balance between S and E has to be related to investment I.

In a kinetic analysis, let's use investment in steel tubes as our base and express all other costs in incremental terms compared with steel.

Material	Incremental Investment	Incremental Savings/Yr.	Percent Return
Aluminum	$600	$300	50
Brass	800	100	12½
Stainless	1,600	320	20

On a kinetic basis, then, we find that aluminum shows up best.

Suppose, however, that aluminum had to be eliminated for process reasons and that management insisted on a minimum return, before taxes and depreciation, of 25%. We would have no acceptable alternative but to retube the exchanger with steel tubes, despite the fact that annual cost of both brass and stainless were lower than that of steel.

An Engineer's Job

Let's look again at our equation for the kinetics of money. Table I shows how various engineering functions affect the relationship. Similarly, I believe that you can categorize any other useful engineering function according to the effect it has in maximizing S and Y and minimizing E and I.

Now you cost engineers who make economic studies every day know all about the kinetics of money. But

Engineers Influence Money Kinetics Here — Table I

These maximize S:	These minimize E:
Selling	Mechanization
Customer service	Standardization
Advertising	Corrosion studies
Public relations	Yield studies
Market development	Operating supervision
Quality control	Study of financing
Packaging	
These maximize Y:	**These minimize I:**
Market research	Plant design
Process research	Inventory control
Pilot-plant studies	Selecting alternates
	Leasing studies
	Construction cost control

many of your fellow engineers are less sophisticated in their approach to such problems as picking the best material for heat-exchanger tubes. This offers a challenge to expand the scope of cost engineering activities. Economics is such a basic part of engineering that I believe all engineers should understand and practice the principles of cost engineering.

Within the past few years we have seen the formation of the American Assn. of Cost Engineers. American Society for Engineering Education has formed an Engineering Economy Div. to recognize that more colleges put greater emphasis on engineering economics in their engineering curricula.

There has been tremendous growth in the published literature in this field, both in book form and in periodicals. And the old-line engineering societies, such as AIChE, have been scheduling many papers and symposia on such subjects as cost estimation and profitability analysis.

Too, a gradual shift in economic responsibility from the owner-manager to the engineer was pointed up in an editorial in *Chemical Engineering Progress* several years ago: "Looking back over the past 35 years, it is surprising to recall the reluctance of manufacturers in the chemical and allied industries (and presumably in all others) to admit their technologists into the field of economics. Gradually, and for the most part at the insistence of technologists themselves, this field has been opened up to them, until at the present time access to cost figures is fairly general, as is the reliance on the technical staff for economic analyses and appraisals of old processes and new developments."

Today there are many full-time practitioners of the science and art of cost engineering. These engineers are intimately concerned with the over-all rate or profitability equation rather than with any single function aimed at maximizing *S* or *Y* or minimizing *E* or *I*. This is especially true in research and development.

Shifting Research Economics

The economic analysis function has only recently come into its own in the research and development end of the chemical business, for example. Other major items of expense have always been subject to careful scrutiny. Purchasing agents look for all angles to save a few cents per ton when buying raw materials. Project engineers go out for competitive bids on plant equipment and analyze each bid carefully to make sure of getting the best buy.

Yet U. S. manufacturing industries this year are spending nearly as much for research and development as they are for plants and equipment. And next year, according to McGraw-Hill's survey of business plans, research expense will exceed capital spending.

Unlike the close control exercised over capital spending, industry does not know what it is getting for its research dollar. The National Industrial Conference Board, in summarizing a survey on research and development expenditures, says that the task of determing the ultimate value of individual research "is a difficult and at times impossible one for many companies." More than half those participating in the survey had no method for assessing value of their research after its conclusion.

Here is an anomoly in our well-organized, well-managed industrial society — a $9-billion dollar research industry flying by the seat of its pants, with inadequate economic guidance! This situation has come about because of the extremely rapid growth of industrial research.

Modern industrial research is not much more than 30 years old. For about the first 20 years of this period, according to E. D. Reeves, Esso Research vice-president, the benefits of research far outweighed its cost. By 1947, however, industrial research cost the country some $1.8 billion per year and was beginning to cost some companies sizable sums of money. Did it have to cost so much? This question, asked more and more by management, started industrial research into a new era. "Its pioneering days were over," says Mr. Reeves, "and from this point on, industrial research had to be efficient as well as productive."

A group of investigators at Case Tech, with support from National Science Foundation, is now seeking answers to such fundamental questions as: "What good is research? Is the money spent on research being allotted for the best results? Is it possible to develop a method for budgeting research within a firm to obtain a maximum return in profits?" One aspect of the study "involves the establishment of standards for judging individual research projects, and when they should begin and end."

Cost Man's Work Cut Out

Taking the lead in the new approach to research economics have been the chemical and petroleum in-

(Continued on page 34)

Evaluate Projects by Time Value of Money

E. H. Flewellen, Jr., Texas Instruments, Inc., Dallas, Texas

SELECTION of profitable projects depends on successive decisions between possible alternate projects. Judgment merely on hunch is dangerous; a study of differences between the several projects is required.

Every prospective difference between projects should be considered in the final choice. Almost always, some differences are not readily reduced into terms of money and time, but choice can be narrowed considerably by reducing into one term all differences of timing and amounts of money flows. The effect of different money flows at different times is accurately reflected by the use of a single interest factor to express the time value of money.

This general method of project profitability analysis is called discounted cash flow, present worth or future worth, depending on minor variations in its application. In discussing project evaluation by the time value of its use of money, we will first illustrate its application and second present several concepts and philosophies that have been helpful in its application and explanation.

To determine time value of money for a project, the first step is development of a cash flow schedule that describes the project in terms of time and money. Second step is to compute the value of interest that reflects this schedule.

Cash Flow Schedule

Table I shows the project cash flow schedule for a hypothetical project. "Zero time" of this project is Jan. 1, 1959. During 1959, a total of $1.2 million is spent for construction of facilities to be used in operation of the project. This is entered as a negative amount of fixed capital on Line 10 of Table I in first year of project.

At Jan. 1, 1960, just before operation begins, $800 thousand book value of existing fixed-capital facilities is transferred to this project for its exclusive use. It's also necessary to provide $70 thousand of working capital to initiate operations.

The first operating year is 1960, and during this year $800 thousand total income is obtained. Costs, totalling $373 thousand, cover $173 thousand for expenses exclusive of depreciation and $200 thousand depreciation allowance. An income tax rate of 52% is applied to the $427 thousand profit before taxes on Line 5 to result in profit after taxes (Line 7) of $205 thousand.

This profit during 1960 is the first cash flow *from* the project. During its first year of operation the project also generates $200 thousand from the depreciation allowance that appears in Line 8. However, since operating level increases during the year, a total of $10 thousand additional working capital is put into the project. No new fixed capital is required during this first operating year. The total cash flow from the project during 1960, shown on Line 11, is $395 thousand.

Project operation continues during 1961, providing $397 thousand total cash flow. By Jan. 1, 1962, three years after zero time, operating rate has increased so that it's necessary to expand facilities that cost $300 thousand by instantaneous purchase. This inflow to the project appears on Line 10 under column headed "At 3." Total income to the project increases to $1.1 million during 1962, and as a result of operations $440 thousand total cash flow is obtained from the project.

For our example, the study period begins at Jan. 1, 1959, and ends at Jan. 1, 1963. Total end value at the beginning of 1963 is shown on Line 11 as $1.78 million. This end value can have at least two practical interpretations. First, it can represent actual liquidation of the project with realization of full value of the working capital and sales of fixed capital facilities at their book value after depreciation.

A second interpretation would be that for comparison with other projects the study period is arbitrarily ended at Jan. 1, 1963, and a value is placed on the going operation. The case in point takes net book value for capital as fair value of the going project.

Computation of the Interest

Determination of the interest rate that represents time value of the use of money in the project is presented in Table II.

The total cash flows of Table I have been repeated with the corresponding study period times at the left in Table II. To their right are columns headed 2, 5, 10, 20 and 40 percent per year. Under each value of interest are shown worth factors (PWF) and present worths (PW).

Present worth factors for each annual interest rate multiply the appropriate total cash flow entry to give the present worth. For example, the "negative" $1.2 million that flows into the project during the zero-to-one year is multiplied by 0.990, the PWF in the 2%/yr. interest column to give a negative $1.188 million PW.

In each interest column of Table II, there are negative present worths for inflows to the project and positive PW's for monies taken from the project. For each column a total PW has been calculated and en-

tered on the bottom line. For the 0%-per-year column, the total PW of the cash flow schedule is $642 thousand. As values of interest increase to the right across the table, the total of the calculated present worths decreases to zero at 10%-per-year interest, becoming negative $828 thousand for 40%-per-year interest.

The interest that measures time value of the use of money in this project is the interest that makes total present worth of all inflows equal total present worth of all outflows. For our case, this equality occurs at 10%-per-year interest. The project cash flow schedule of Table I represents 10%/yr. time value of the use of money in the project.

Cash Flow Schedule Philosophy

One objection frequently raised about use of time value of money in project evaluation is the need for accurate, complete monetary description of the project. Prediction of all future events is uncertain to some degree, and the accuracy of any economic evaluation, regardless of figures used, is inherently no better than the description of the project in terms of money and time.

Description of the project by its cash flow schedule is fundamental to economic evaluation. Consider this analogy: there is a pocketbook (responsibility) for money. Sometimes monies of various kinds from this pocketbook will be put into the project. Too, the project will return to this pocketbook several kinds of monies from time to time. Project evaluation seeks the time value of money *to the pocketbook* from execution of the project.

There are usually other flows to and from the project being evaluated that affect the pocketbook only indirectly. The project (perhaps) receives income, pays its employees and suppliers and may have to pay taxes.

Looking at the total cash flow to and from the project shown in Table I, it's obvious that total cash flow is the sum of several individual streams. In this case it's comprised of fixed capital, working capital, depreciation and amortization, and profit after taxes. There are legal and administrative purposes for segregation of these several streams, but return on investment is for the total of all flows, regardless of nature.

Four Streams Make Total Flow

Fixed capital covers expenditures for project facilities that will be used longer than one year. Such items may be subject to depreciation, such as machinery and buildings, or may be nondepreciable, such as land.

Inputs of fixed capital to the project may be represented by purchase price of equipment, construction costs of new facilities or book value of existing fixed capital items that are used by this project to exclusion of other projects. Outflows of fixed capital are represented by sale price, salvage value or book value for transfer of facilities from this project to others for different use. The key point here is to recognize fixed capital transactions in the manner that the project organization keeps its books.

Working capital is the net of current assets and liabilities. Many projects have been evaluated without adequate consideration of working capital. Frequently there is either separate responsibility for working capital and operating costs, or the details of working capital accounts do not show allocation to separate departments or projects.

However, working capital requirements for cash on hand, inventories of all kinds, and accounts receivable are realistic components of the business economy. For more accurate project evaluation, it is necessary to recognize the impact of working capital requirements, even though recognition may be only by estimates of amounts and timing.

PROJECT CASH FLOW SCHEDULE — TABLE I*

Calculation	Line No.	Calendar Time / Years After Zero-Time	1959 0 to 1	1/1/60 At 1	1960 1 to 2	1961 2 to 3	1/1/62 At 3	1962 3 to 4	1/1/63 At 4	Study Total
		Operating Statement								
Given	1	Total income			$800	$900		$1,100		$2,800
		Costs								
Given	2	Depreciation			200	200		230		630
Given	3	Other expenses			173	269		391		833
2 + 3	4	Total costs			373	469		621		1,463
1 — 4	5	Profit before taxes			427	431		479		1,337
0.52(5)	6	Income tax @ 52%			222	224		249		695
		Cash Flows to Project								
5 — 6	7	Profit after taxes			205	207		230		642
2	8	Depreciation			200	200		230		630
Given	9	Working capital		$ (70)	(10)	(10)		(20)	$ 110	0
Given	10	Fixed capital	$(1,200)	(800)			$(300)		1,670	(630)
	11	Total Cash Flows	$(1,200)	$(870)	$395	$397	$(300)	$ 440	$1,780	$ 642

*All amounts shown in columns above are thousands of dollars.

Concept of Time Value of Money

Given a description of a project from a schedule of time and amounts of money flows, it's necessary to recognize the growth element of money in use as a time value of the money. Combination of all of these effects is accomplished through the concept of interest.

Interest is money paid for the use of money. It is a rate of growth relating three things:

- Amount of money in use.
- Amount of earnings or profit generated by the use.
- Time in which money is in use and flows, both into and out of the project.

The fundamental relationship of interest is in units of $ of profit/$ in use per year, commonly expressed as %/yr.

Frequency of Compounding

There are at least three bases for determining the amount of money used in the production of profit. For *simple interest*, money to be paid as a return is based on the original principal only.

For *periodically compounded interest*, money due at the end of each period is based on the amount tied-up at the end of the previous period — the original principal plus the accumulated interest, or earnings, which had not been paid when due. Use of periodically compounded interest is customary in banking practice to reflect agreements under which money is loaned and repaid, with determination of the interest to be made at end of each period. Frequency can be annual, semi-annual, quarterly or even monthly.

For *continuously compounded interest*, the rate at which money is due at each instant is based on the amount tied-up at that instant — the original principal plus interest, or earnings, accumulated but not paid when due at each instant. Most economic evaluations are made of ventures that can be considered of a continuous nature and that exhibit many times during a year cash flows and changes in amount of money tied-up. This third definition is what we mean when we speak of "interest" here.

Equivalence of Worths

In the simplest case, a single instantaneous flow of money enters the project. While in use, it grows in value. At some later time a single instantaneous outflow of money from the project is obtained, which includes both original input of money and profit generated by use of this money. The rate of growth between the times of inflow and outflow is measured by interest.

It's possible in project evaluations to maintain separate identity of paired inflows and outflows of money. It's more convenient and equally accurate, however, to establish the equivalent worths of these two flows knowing the interest that measures rate of growth of the money in use.

The concept is to translate the amount of money flowing in at a given time into a reference point value, the zero-time worth of the inflow. This translation is prescribed by interest factors. Using the same translation rules for the paired outflow in this simplest case, a zero-time worth is obtained for it. The zero-time worth of the inflow will be equal to the zero-time worth of its paired outflow. Therefore, it is said they have equivalent worths.

In the broadest sense, it is not necessary to segregate and paired inflows and outflows of monies that describe projects being evaluated. All inflows can be separately translated to their respective zero-time worths. A total, inflowing zero-time worth is the arithmetic sum of the individual equivalent worths. Too, all outflows can be individually translated into their respective zero-time worths and their total obtained. Since translation of all flows is made with the interest that expresses the rate of growth of all money in use in the project, the total of inflowing and outflowing zero-time worths will be equal.

Choice of zero-time for this translation has no effect on the time value of money as measured by interest. The zero-time can be earlier than any of the money transactions, it can be later than any of them or it can be at some intermediate time between first and last cash flow describing a project.

If the zero-time point is earlier than all transactions, this time is customarily known as the present time, and the zero-time worths are called present worths. If the zero-time is later than all transactions to and from a project, custom is to describe the reference point and value as future time and future worth.

Interest Factors

Translation of actual flows at actual times into zero-time worths is accomplished by interest factors. In the description of actual projects to be evaluated, some flows of money occur instantaneously and some flows occur uniformly and continuously during individual years. Two different factors are needed to translate to zero-time the worth for these two conditions under which money flows.

For an instantaneous flow of money at time t, the translation with interest i to zero-time worth is made with a factor defined as follows:

$$F = e^{-it} \qquad \text{A}$$

where e is base of the natural log. This factor is the ratio of zero-time worth to actual amount at time t.

For a total flow of money occurring uniformly and continuously during one year closing at time c, translation with interest i to zero-time worth is

$$F = (e^{i} - 1)\, i/e^{-ic} \qquad \text{B}$$

For both factors, actual times t and c later than zero-time are positive. Conversely actual earlier times are negative. Profitable uses of money result in positive values of interest. Negative interest reflects losing projects, or decay of money.

Working capital and fixed capital cash flows to and from a project reflect changes in total book value of a project from the financial balance sheet. The total book value can be obtained in two ways from the assets and liabilities of a typical corporate balance sheet.

First, working capital is taken as the difference between current assets and current liabilities. Then total book value is the sum of working capital, net book value of fixed assets and investments. In the second way, using only the liabilities side of the balance sheet, total book value is the sum of common stock equity, par value of preferred stock, reserves and long term debts.

Depreciation and Amortization

The question frequently arises as to whether or not allowances for depreciation and amortization are to be included as cash flows from a project to the pocketbook. Consideration of the nature of these items answers this question.

The depreciation allowance schedule is one of the rules by which total costs are calculated. It is applied to distribute cost of facilities with long life over the several operating periods during which the facilities are used. Although there are several bases for figuring depreciation, the choice of proper base is not a point in question here; rather, it's whether or not the allowance is to be part of the project cash flow.

Determination of income tax is by prescribed rules for recognition of depreciation and amortization.

Having determined the proper rules to account for depreciation in cost and tax calculations, the next decision is to identify responsibility for custody and use of accumulated depreciation and amortization reserves. Is management of the project under evaluation to be held responsible for use of the reserves instead of returning depreciation and amortization funds to the pocketbook? If so, depreciation and amortization are not a part of the period-to-period cash flows between the project and the pocketbook.

Does the project release responsibility for depreciation and amortization allowances and return this money to the pocketbook period-by-period? If so, depreciation and amortization should be considered as a cash flow from project to pocketbook.

The principal of recognition of depreciation and amortization as part of the cash flow schedule reflects responsibility for custody and control of the allowance as it is experienced in actual execution of the project.

Profit After Taxes

Period-by-period calculation of profit after taxes is obtained from the operating statement for the project being evaluated. This cash flow stream is incorporated as part of the total cash flow to and from the project. The calculation of profit after taxes in Table II illustrates only major subtotals in the operating statement. Usually more details are needed to appraise the realism and the completeness of the statement.

It's convenient to have a prepared form, similar to Table I, with item entries on the left reflecting customary accounts and account subtotals established for the organization that will execute the project. Headings for time periods on columns to the right should be left blank. When developing the cash flow schedule of a project, the appropriate calendar times and study period times can be entered to serially order the flows of monies. The study total column at the right facilitates arithmetic check of the project description.

Changes in Projects

Time value of money appraisal is to be applied to one complete schedule of total cash flow transactions from time to time that reflects the net of all activities embodied in a single project. Any alteration in timing or amount of cash flows in the schedule actually creates a different project.

One typical alteration of time and amounts of cash flows is a revision of sales forecast of products to be manufactured in the project. This obviously creates a new and different project which also may be characterized by its own time value of money. Another example is the different fixed capital requirements and operating costs associated with alternate choices of facilities to provide the same output.

(Continued on next page)

CALCULATION SHEET WITH CONTINUOUSLY COMPOUNDED INTEREST — TABLE II

Time	0%	2%/Yr.		5%/Yr.		10%/Yr.		20%/Yr.		40%/Yr.	
Year	PW	PWF	PW	PWF	PW	PWF	PW	PWF	PW	PWF	PW
@ 0		1.000		1.000		1.000		1.000		1.000	
0-1	$(1,200)	0.990	$(1,188)	0.975	$(1,170)	0.952	$(1,142)	0.906	$(1,087)	0.824	$(989)
@ 1	(870)	0.980	(853)	0.951	(827)	0.905	(787)	0.819	(712)	0.670	(583)
1-2	395	0.971	383	0.928	367	0.861	340	0.742	293	0.552	218
@ 2		0.961		0.905		0.819		0.670		0.449	
2-3	397	0.951	378	0.883	350	0.779	309	0.608	241	0.370	147
@ 3	(300)	0.942	(283)	0.861	(258)	0.741	(222)	0.549	(165)	0.301	(90)
3-4	440	0.932	410	0.840	370	0.705	310	0.497	219	0.248	109
@ 4	1,780	0.923	1,643	0.819	1,458	0.670	1,192	0.449	799	0.202	360
Total	$ 642		$ 490		$ 290		$ 0		$ (412)		$(828)

Note. PW is present worth; PWF is present worth factor.

Introduction of plans for reinvestment of funds generated by a project previously described implies that funds will not be returned to the pocketbook but will be put into an investment returning x %/yr. Complete description of the use of this money includes not only the primary activities first envisioned, but a profit-generating activity better known as a bank.

Inclusion of the effect of withdrawal or reinvestment of money in a bank in the total cash flow schedule may appropriately describe intentions of management. But there are now three separate projects which can be described and evaluated for effect on the same pocketbook from whose viewpoint three alternate time values of money are determined.

First as a complete alternate, there is an operating activity which can stand alone and receive and generate funds. Second, there is a bank, or an investment opportunity, which also can be connected with the pocketbook as a separate and alternate use of money. Third, there is another prospect which is comprised of both the operating activity and the bank. During the study period, in this case, monies flowing between the operating activity and the bank are not part of the total cash flow schedule to and from the pocketbook.

Return on investment is determined for a total cash flow schedule between a source of funds and a complete system of operations or set of uses of monies. This total is the net of several different cash flows that are identified and segregated for legal and administrative purposes. A separate and different project having its own time value of money is created for any difference of amount of money, time of money flow and use of money as reflected in the cash flows associated with each complete project description.

Message from the President

(Continued on page 23)

Have recently received a copy of a new edition of the book, *PRINCIPLES OF ENGINEERING ECONOMY* by E. L. Grant and W. G. Ireson, The Ronald Press Company, New York. It is a very much advanced treatise over the past edition. Great stress is put on concepts and methods. It starts off in discussing "Hunch" decisions. One quote is a series of questions:

1. Why do this at all?
2. Why do it now?
3. Why do it this way?

Found the book very provocative in its treatment of decision making, dealing with uncertainties in forecasts, dealing with multiple alternatives, cash flow concepts, income tax and other subjects of real interest to cost engineers. For example, "What Interest Rate?" Think it would be worth your while to look it over.

All for now. See you in Houston.

Personnel Service

With the objective of increasing the services to our members, the *Bulletin* includes a Personnel Section.

Members will be permitted two free insertions in the "Men Available" section per year.

There will be a charge for insertions in the "Positions Available" section. Write to the Editor, *AACE Bulletin* for additional information.

MEN AND POSITIONS AVAILABLE

Manufacturing Engineer — degree; graduate training in Business Administration and Accounting; 18 years experience — 10 on the professional level in all phases of light manufacturing; some technical writing and editing; member AACE and ACS; presently Chief Ind. Engineer, Kenneth Kahn, Route No. 3, Shippensburg, Pa.

ENGINEERING COST ESTIMATORS

The Chemstrand Corporation, manufacturers of Acrilan and Chemstrand Nylon(R) needs engineers, experienced in the following:

- Construction and Project Cost Estimating
- Construction Scheduling
- Cost Analysis and Control

Bachelor's Degree in Engineering (preferably Chemical or Mechanical Speciclization) required with a minimum of 5 years' Engineering experience in the above activities related to the design and construction of major chemical and/or synthetic fiber facilities. Occasional travel and temporary duty assignment at project site involved. Excellent benefit plan. Salary commensurate with training and experience.

Send resume of background including salary history and requirements in confidence to

Manager — Technical Employment & Recruitment
Box ED6
The Chemstrand Corporation
Decatur, Alabama

(R) Registered Trademark

Technical Papers

Available free, AS LONG AS THEY LAST, to AACE members, (.50 to nonmembers), by request:

1 — "Accurate Ways to Estimate Pipe Costs" by W. G. Clark
2 — "Computer Speeds Economic Evaluations" by J. F. Adams, W. L. Massey Jr. and M. Dmytryszyn
5 — "Ratio Cost Engineering" by H. C. Bauman
6 — "The Cost of Preparing an Estimate" by K. G. Wolfe
7 — "Which Depreciation Method is Best" by B. J. Gaffney
18 — "Estimate Cost of Compression Plants" by I. Bromberg
20 — "Estimate Cost of Fractionation Systems" by I. Bromberg
21 — "Educational Requirements from the Standpoint of Industry for Future Engineering Graduates" by D. I. Meikle
23 — "The Case for Scientific Research in Cost Engineering" by L. R. Shaffer
24 — "A Course in Chemical Engineering Economics" by J. Happel
25 — "Cost Control in Construction" by W. McGlaun
27 — "Economic Evaluation of Research Projects" by R. C. Brown
28 — "Statistical Methods in Cost Engineering" by A. F. Dershowitz

The Association is endeavoring to publish in the *Bulletin* or make available reprints of papers that are related to the field of Cost Engineering. If you are preparing a paper or have presented previous papers in this field please send a copy to the Editor so that it can be included in future surveys of data in this area.

News from the Regions

ORGANIZATION OF NEW SECTIONS

In order to provide an opportunity for group activities at the local level, the AMERICAN ASSOCIATION OF COST ENGINEERS encourages the formation and establishment of regional sections.

The advantages of closer personal relationships, opportunities for discussion of mutual problems and the frequent dissemination of data vital to the profession are a few of the reasons for joining or forming a section.

If you reside in an area not covered by an existing section and would like to benefit from and assist in its organization, contact: Wesley J. Dodge, *Chairman, Regional Sections Committee, AACE,* 110 Pinewood Road, Manhasset, New York.

Members residing in the following areas can write to the people listed below. These men are "Spark plugging" sections in their regions.

Baton Rouge, Louisiana
Carlo H. Polito, Ethyl Corporation, P. O. Box 341, Baton Rouge, Louisiana.

Detroit, Michigan
Gilbert A. Smith, The Bristol Company, 10329 West Nichols Road, Detroit, Michigan.

Essex, England
John H. Herbert, 22 Fairway, Leigh-On-Sea, Essex, England.

Kansas City, Missouri
Lloyd E. Weast, Jr., 3817 East 72nd Street Terrace, Kansas City, Missouri.

Los Angeles, California
Frank M. Russell, AETRON, Estimating Department, 410 North Citrus Avenue, Covina, California.

Miami, Florida
John A. Condon, 691 Northwest 45th Street, Miami 37, Florida.

Ontario, Canada
Frank Grosvenor, The Hydro-Electric Power Commission of Ontario, 620 University Avenue, Toronto 2, Ontario, Canada.

Quebec, Canada
James Bachman, 175 Hemlock Drive, Beaconsfield, Quebec, Canada.

Seattle, Washington
Edward Fila, 1201 Warner Street, Sedro-Woolley, Washington.

South Charleston, West Virginia
W. F. Gott, Union Carbide Chemicals Company, P. O. Box 8361, South Charleston, West Virginia.

St. Paul, Minnesota
Dr. Bernard J. Gaffney, Wood Conversion Company, First National Bank Building, St. Paul 1, Minnesota.

Members in the Cincinnati, Niagara Falls, Oak Ridge, Savannah and St. Louis areas are working on the organization of sections in their regions. If you would like to help develop a section in these areas contact Mr. Wesley J. Dodge.

CHICAGO-MIDWEST SECTION

The April meeting of the Chicago-Midwest Section was held in a conference room at the Cook County Highway Department Building in Chicago. Speaker of the evening was Mr. Harold Wolt of Westinghouse Corporation, who discussed "New Electrical Equipment for General Industry Use — Possible Escalation on Electrical Materials."

Results of the April election of Chicago-Midwest Section Officers and Board for 1960-61 follow:

Chairman — William Twaddle, AMOCO Chemical Corporation.

Vice-Chairman — Harold Stamps, DeLeuw, Cather and Company.

Secretary — Daniel Brink, Corn Products Company.

Treasurer — Constantine Tsaros, Gas Institute, Armour Research Foundation.

Director — John Mark, The Pure Oil Company.

Nominating Committee for 1961: Don Meikle, Meissner Engineers, Incorporated; John Foushi, Inland Steel Company; and Clovis Dyckman, Standard Oil Company (Indiana).

The Profitability Symposium was held on May 16th at the Furniture Mart of America, 666 North Lake Shore Drive, Chicago, and consisted of an all-afternoon session, a cocktail hour and dinner followed by an evening session. The symposium was open to both AACE members and non-members.

Secretaries of all AACE sections were mailed programs in order that an invitation to attend could be extended to members of other sections.

1:00 P.M. **Introduction** by Henry C. Thorne, Project Evaluator, Amoco Chemicals Corporation

1:10 P.M. **Evaluating a Consumer Product** by Stephen H. Boll, Department head, Consumer Cost Estimating Motorola, Incorporated

1:10 P.M. **Application of Discounted Cash Flow Procedures in the Petroleum Industry** by Lucian L. Vestal, Financial Analyst Pure Oil Company

2:10 P.M. **Economic Evaluation of Chemical Projects** by W. W. Twaddle, H. C. Thorne, E. R. Grahl Amoco Chemicals Corporation

2:40 P.M. Intermission

2:55-5 P.M. Panel Discussion — Evaluating Profitability Techniques

Introductions by W. W. Twaddle, Panel Moderator Amoco Chemicals Corporation

The Profitability Index Technique by W. D. McEachron, Head, Long Range Planning Group, Standard Oil Company (Indiana)

The Present Value Technique
by D. Bodenhorn, Assistant Professor of Business Economics, Graduate School of Business, University of Chicago

The M A P I Technique by Gerold J. Matchett, Professor of Economics, Illinois Institute of Technology & Director, National Center of Education and Research in Equipment Policy

Accounting Forecasts as a Tool in Evaluation
by Ernest H. Weinwurm, Professor of Accountancy, Depaul University

After cocktails and dinner, the address of the evening was delivered by Mr. Thomas M. Ware, President, International Minerals and Chemicals Corporation, Skokie, Illinois.

The Program Committee for the Profitability Symposium consisted of:

Mr. Henry C. Thorne, Chairman — Amoco Chemicals Corporation.

Mr. Harry A. Kunberger — The Pure Oil Company.

Mr. Edward R. Grahl — Amoco Chemicals Corporation.

Mr. Stephen H. Boll — Motorola, Incorporated.

POTENTIAL KANSAS CITY AREA SECTION

On April 9th our organizer for the potential Kansas City, Missouri area section, Lloyd D. Weast, Jr., held a workshop for people in the area interested in starting a section. Meeting topics included "Aims and Objectives of the American Association of Cost Engineers," "Organization of an Estimating Department," and "Cost Indexes." Invitations were issued to 15 firms in the area and the response was encouraging.

METROPOLITAN NEW YORK SECTION

The Annual General Meeting of the Metropolitan New York Section was held in the Manhattan Hotel, New York City on April 28th. Chairman Wesley D. Dodge presided, and the meeting was well attended by 55 members and guests.

The Cost Control Committee presented a paper on "Essentials of Cost Control for Capital Plant Expenditure," and the Estimating Methods Committee presented a paper entitled "Application of Computers to Capital Cost Estimating." Both these papers were well received and will be presented at the AACE Convention in Houston.

The newly elected officers for 1960-61 are:

Chairman — Cecil H. Chilton, Editor, *Chemical Engineering.*

Vice Chairman — Irwin Bromberg, Foster Wheeler Corporation

Secretary — Kenneth M. C. Guthrie, The M. W. Kellogg Company

Treasurer — Arthur P. Lothrop, Universal Atlas Cement, Division of U. S. Steel Corporation

Director (2 years) — Donald F. Brosnan, Vitro Corporation.

An illustrated talk on "Gas Turbine Compressor Design and Cost" was delivered by Mr. C. Dygert of the General Electric Company and Professor Rath of New York University discussed "Cost Control from the Industrial Designer's Point of View."

NEW ENGLAND SECTION

The New England Section held a January 12th meeting at the Massachusetts Institute of Technology with Mr. Richard D. Ayres of the Chicago Bridge and Iron Company as featured speaker. Mr. Ayres presented an excellent movie on the evolution of a 190′ diameter hortonsphere for the Dresden atomic reactor. A lively question and answer period followed.

During the business meeting letters were read by President H. J. DeLamater on the following items:

1. request from William Hand asking each regional section to select a subject for participation in the national Capital Cost Committee project;

2. letter from the Engineering Societies of New Eganld (ESNE) announcing acceptance of the section as an affiliate of that body;

3. appeal from Earl Clark for papers and talks for the 1960 national convention.

The February 9th meeting of the section was held at the Massachusetts Institute of Technology. During the business meeting President DeLamater announced that the 1961 National Convention, which the section is hosting, will be held at the Somerset and Kenmore Hotels,

Mr. Robert Walker of the H. H. Robertson Company presented a very informative talk on "Curtain Wall Construction." This was followed by a spirited discussion.

A heavy snowstorm postponed the March 8th meeting until March 16th when the meeting was called to order by Vice-President Walter Langhoff. An executive committee meeting was called for March 22nd to appoint a nominating committee for the forthcoming election of officers.

Featured speaker of the evening was Mr. Robert T. Thomas of the Worthington Pump Corporation, who presented a very interesting and informative talk entitled "Selection and Cost of Pumps."

The April meeting of the section was called to order by President H. J. DeLamater. The business portion of the meeting consisted of:

1. reading of nominations recommended by the Nominating Committee for 1960-61 officers

2. a report from the treasurer that the section has 35 paid members and a cash balance of $129.06; and

3. reading of an invitation to the section members to attend the luncheons of the Engineering Societies of New England.

Mr. O'Connell of the Perrini Corporation handed President DeLamater a letter from which he read excerpts as an introduction to the main speaker of the evening, much to the amusement of the members. Mr.

Philip Dwyer, the speaker, gave a most interesting talk on the "Problems of Cost Estimating." Mr. Dwyer answered numerous questions following his address.

Voting was heavy for the election of New England Section Officers and Board for 1960-61, and the following people were elected to office:

President — Walter H. Langhoff, Metcalf & Eddy.

Vice-President — Bernard Fefferman, Badger Manufacturing Company.

Secretary — Philip E. Johnson, Lawson Machine & Tool Company.

Recording Secretary — Miss Marion B. Seufert, Badger Manufacturing Company.

Treasurer — Verne R. Hillman, NRC Equipment Corporation.

Directors — Daniel J. O'Connell, Jr., Perinni Corporation; Harold J. DeLamater, Industrial Estimating Service; Charles V. Keene, Metcalf & Eddy.

After the installation of the above slate the new president's first official act was the appointment of the following committee chairmen:

Program Committee — Ed Johnson, American Bridge Co.; Membership Committee — Daniel O'Connell, Perinni Corp.; Philip Johnson, Lawson Machine & Tool Co.

NORTHEASTERN OHIO SECTION

The April dinner meeting of the Northeastern Ohio Section was held at the Cleveland Engineering and Scientific Center. It was followed by a talk by Mr. James Dawson, Vice-President and Economist for The National City Bank of Cleveland, who presented a very interesting and authoritative picture of future business activity in his talk, "A Crystal Ball Look at Business."

PITTSBURGH SECTION

The March 9th dinner meeting of the Pittsburgh Section was held at the Royal York Restaurant, with Vice-President C. E. Center presiding in the absence of President J. H. Black. Attendance was 27 members and guests.

Vice-President Center urged members to seek new members from their industrial acquaintances. In response to a question from the floor, Mr. Center stated that the Secretary was preparing a current membership listing which would be available to all section members.

Mr. A. W. Seekins, Chairman of the Nominating Committee, announced the results of the election of officers for 1960-61:

President — C. E. Center, Westinghouse Electric Corporation.

Vice-President — J. F. Rigatti, Koppers Company, Incorporated.

Secretary — J. T. Connell, Dravo Corporation.

Treasurer — H. O. Mitchell, Koppers Company, Incorporated.

Director (2 years) — J. F. Lovett, Pittsburgh Coke and Chemical Company.

Following the business meeting, Mr. Henry W. Rahn, Coordinator of Research and Development for Columbia Southern Chemical Company, spoke on "How to Evaluate Research and Development." His talk was followed by a question and answer period.

A joint meeting of the 1959 and 1960 Boards was held on March 29th.

President Black read a letter from Cecil Chilton accepting an invitation to speak at the April 27th meeting. A written request by the Pennsylvania Society of Professional Engineers to speak at a section meeting was considered and referred to J. F. Rigatti for invitation to a fall meeting. In response to a request from AACE National Nominating Committee, Board members rated their preferences for the several nominees for each office; these were referred to President Black for tabulation and return to the Nominating Committee. President Black then turned the meeting over to the new president, C. E. Center.

President Center appointed Dr. J. H. Black to be the Pittsburgh Section's representative to the Regional Activities Committee.

A letter from the Corning Glass Works was read by President Center which confirmed that firm's participation in the Ladies' Night meeting scheduled for May 19th. A tentative schedule of meetings was adopted, as follows: Oct. 12, Nov. 9, Jan. 11, Mar. 8 and Apr. 12.

On April 27 a dinner meeting was held at the Royal York Restaurant. The business meeting was called to order by retiring President Dr. James H. Black who introduced the section's new president, C. E. Center.

An appeal to all section members was made by President Center to solicit actively new members for the section. He indicated that a large number of companies with potential interest in the work of the AACE were not now members.

President Center announced the appointments of Dr. James H. Black to the Regional Activities Committee and Dr. Philip J. Wilson, Jr. to the national Publications Committee. National Director Sidney Katell was introduced and remarked that copies of talks before the local section should be considered for publication in the *AACE Bulletin.*

Dr. James H. Black introduced the speaker, Cecil Chilton, national AACE Treasurer and Editor of *Chemical Engineering* magazine. Mr. Chilton's subject was "Vapor Pressure of Money" and dealt with evaluation of applied research costs in terms of capital investment cost and return on investment. This paper is reproduced in this issue of the *AACE Bulletin.*

Mr. Chilton also spoke of national AACE affairs including publication of the *AACE Bulletin,* the *Cost Index Manual,* membership directory, and membership certificates. He reported on a cost engineering bibliography being prepared jointly with the Bureau of Mines. He also announced that AACE is making application for associatt membership in the Engineers Joint Council.

Current Cost Capsules

BAUMAN, H. CARL. "Cost of Starting Up The Chemical Process Plant," *Ind. Eng. Chem.*, 52, No. 3, (March 1960), 51A-52A.

Explains start-up expense and how these costs are developed. Table included showing construction start-up expense as percent plant installed cost.

Chemical Week. "Energy Outlook — Quick Climb, Steady Shift in Sources," 86, No. 20, (May 14, 1960), 64-90.

Discusses energy sources, shift in sources, and increase in demand. Oil remains plentiful and inexpensive. A barrel of crude now costs $2.93 and is cheaper overseas. Natural gas prices are increasing — price is now 18-19 cents per 1,000 cubic foot. Average mine price of coal is $4.86 per ton.

Chemical Week. "Natural Gas Purifier," 86, No. 19, (May 7, 1960), 44.

First commercial plant that will purify high-pressure natural gas will be built by El Paso Natural Gas Co. Plant will cost $3-million with a capacity of 100-million cubic feet per day. Fluor Corp. developed process, and they estimate a total treating cost of 2 cents per 1,000 cubic feet of gas for solvent removal.

Chemical Week. "Technology Newsletter," 86, No. 19, (May 7, 1960), 67-68.

Titanium parts from powder have been cut from $4-5 per pound to $1.50-2.00 per pound since Clevite Corp. developed a new low cost process.

Coal Age. "Cost Control for Equipment Maintenance," 65, No. 2, (February 1960), 118-121.

Discusses cost-control system for equipment maintenance. Effective control of equipment maintenance will show market effect on total cost of coal production. Sample maintenance cost charts included.

EVANS, HENRY P. "Plant Layout — The First Step Toward Low Cost," *Petrol. Eng.*, 32, No. 3, (March 1960), C-14 - C-18.

Valuable tips on plant layout, uses of models, etc., in reducing initial costs and improving maintenance.

"Estimating has never been one of my strong points."

THE AMERICAN LEGION MAGAZINE

The Vapor Pressure of Money

(Continued from page 25)

dustries. One way they are making their research dollars more productive is by applying economic criteria to research projects in their earliest stages. Yet this is not a universal practice. An eminent chemical industry research director recently said:

"Almost every important industrial research project works against some cost ceiling above which successful technical completion of the project will have no value. Yet how frequently we find our industrial research people guiding their activities without any conception of the relative importance of the various factors which will eventually be considered by the cost accountant when he makes the financial analysis as to whether the new product can be profitably commercialized."

A few simple cost calculations, even before bench-scale work is begun, can often point out the economic obstacles which must be overcome before the process can be a commercial success. Many companies now have groups of cost engineers devoting full-time efforts to making economic studies for research guidance. These studies, repeated at frequent intervals throughout a research project, can avoid fruitless work on an uneconomic process or — just as bad — intensive work on a secondary problem.

In some cases the cost engineer might be justified in recommending that his company abandon its own research in a particular field and buy its technology from an outside source. The maturing of industrial research, with increased competition all around, has resulted in greater availability of technical developments for purchase or licensing.

Dow Chemical Co. recently told its stockholders: "Research probably never has been more important to our immediate and future welfare than in this present era of extreme competition." By the same token, economic evaluation of research, as well as all other items of expense, has never been more important than today.

WHAT'S HAPPENING . . .

Donald G. Adkins has been promoted from Engineer to Supervisor of Estimating, Scheduling and Cost Control in the Engineering and Development Department of The Chemstrand Corporation in Pensacola, Florida.

W. Kenneth Aydelotte, who was formerly Estimator with Clarewood Company, Berkeley, California, is now employed in the same position by the Bechtel Corporation, San Francisco, California.

William T. Brooks, who was formerly affiliated with the Velsicol Chemical Corporation, Chicago, Illinois, is presently associated with the International Minerals and Chemicals Co., Skokie, Ill.

Edward C. Brown has been promoted from Technical Studies Manager in the Development Department of Canadian Industries Limited, Montreal, Canada to Technical Manager of the Plastics Division, same company.

Matthew F. Callahan is now with the Plastics Division of the Allied Chemical Company, Toledo, Ohio. He was previously associated with Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.

Gary D. Cass has been promoted from Sales Engineer to Assistant Sales Manager by the Universal Form Clamp Company of Chicago, Illinois.

Rufus M. Chatham has accepted a position with Kaiser Engineers, Oakland, California, he was formerly with Indenco Engineers, Inc., San Leandro, California.

Herman L. Childress was recently promoted to the position of Assistant to the President and Manager, Economic Analysis, with the California Oil Company, Perth Amboy, New Jersey. He was formerly Manager of Analytical Services for this company.

John A. Condon and **William T. Trotter** have formed a partnership for construction consulting in Miami, Florida.

A. G. Custer has been promoted from Estimator to Administrative Assistant in the Engineering Department of the Celanese Chemical Company, Bishop, Texas.

Robert N. Custer is now Section Chief of Plans and Schedules for the Engineering Department of Sun Oil Company, Philadelphia, Pennsylvania; he was formerly Assistant Chief Estimator.

Louis Dallavia reports that he is offering Cost Estimating Standards Service.

George E. Deatherage, Educational Director of the National Schools of Construction in Satsuma, Florida, reports that he will soon start a new series of articles on the application of industrial engineering techniques to construction work practices for *Contractors and Engineers Magazine*. These articles will be mainly along the lines of job pre-planning, work simplification, etc.; and process charts will be utilized. For the past four years Mr. Deatherage has been authoring the feature "Construction Management" articles for this magazine.

Solomon Disman has been promoted to Assistant to the Director of Development of the Abbott Laboratories, North Chicago, Illinois. He had been a Chemical Engineer with the same company.

Gasper S. Domino has accepted a new position as Chief Draftsman and Estimator for J. C. Mahoney, Inc., New York City. He was previously Cost Estimator for M. W. Kellogg Co., Jersey City, N. J.

William J. Donovan is presently Senior Estimator for the Foster Wheeler Corporation, New York City. He was formerly affiliated with Astrodyne Incorporated and Phillips Petroleum Company, McGregor, Texas.

Norman E. Duncan is now responsible for preparation of proposals for new business as Staff Engineer for the Estimating Department at Arthur G. McKee & Company, Cleveland, Ohio. His previous position with the same company was that of Project Engineer in the Industrial Division.

Thomas H. Eggleston, formerly Senior Cost Engineer with The Ralph M. Parsons Company, Los Angeles, California, is now Chief Estimator, same company.

Daniel G. Evans has been promoted to Senior Chemical Engineer in the Chemical Engineering Department of the Atlas Powder Company, Wilmington, Delaware. He was formerly a Process Engineer.

Eugene H. Flewellen, Jr., who was formerly Head of Financial Planning for Texas Instruments, Inc., Dallas, Texas, is presently Manager of Systems and Procedures, same company.

Frederick A. Franks has been promoted from Planning and Estimating Division Engineer to Supervisor of this division for the American Viscose Corporation, Marcus Hook, Pennsylvania.

John D. Fricke has transferred from the Cleves, Ohio to the Pittsburgh, Pennsylvania office of Gulf Oil Corporation.

D. G. Geraldine is now Senior Estimator for The Fluor Corporation, Los Angeles Branch. He was formerly Technical Advisor, Estimating, same company.

Stanley A. Gertz has been promoted from Assistant Section Engineer, Design Department to Supervisor, Systems Development Group, Administrative Engineering Department, The M. W. Kellogg Company, New York City.

Frank Grosvenor writes that he has been transferred to a staff position in the Engineering Division of the Ontario Hydro-Electric Power Commission, Toronto, Ontario, Canada in order to develop a cost standards control system for capital construction. From January through March he has been consulting on cost control systems for Brazilian interests at the site of a major hydroelectric development on the Rio Grande in the state of Minas Gerais, Brazil.

John W. Hackney reports plenty of activity in his new position of Vice-President for Process Plant Projects at BEACO Ltd., Montreal, Quebec, Canada. Besides some work for the United Nations and several pulp and paper jobs, those with hydro and sewage plant projects are really keeping John busy.

Seth V. Heath recently accepted a new position in the Sales Department of Warren Electric Company, a Houston, Texas company specializing in wholesale electrical material for industrial, petro-chem and refinery accounts. He was previously Design Supervisor in the Electrical Department of The Lummus Company, Houston, Texas.

Newton R. Hill, who was Estimator for The Catalytic Construction Company, Philadelphia, Pennsylvania, is now Estimator for the Porter Engineering Company located in Hatfield, Pennsylvania. This engineering company specializes in sales and installations of glass distillation and fractionation systems and glass piping.

Melville E. Hitchcock is now coordinator of Overseas Chemical Production for Union Carbide International Company, New York City. He was formerly Assistant to the Vice President, same company.

James D. Horst has been promoted to Manager of Cost Control Engineering for The Ralph M. Parsons Company of Los Angeles, California. He was previously Chief Cost Engineer.

Alexander X. Karay, previously affiliated with the Sumner Chemical Company, Zealand, Michigan, is presently associated with the Miles Company, Elkhart, Indiana.

John F. Keefe has been promoted from Chief Estimator to Development Engineer for the Jones & Laughlin Steel Corporation, Pittsburgh, Pennsylvania.

Thomas J. Kent, Jr. has recently been transferred to the London subsidiary of The M. W. Kellogg Company, New York City for a stay of approximately one-and-a-half years. His position in the London office as Manager of Operations will involve visiting Paris (Some men get all the breaks) and Dusseldorf subsidiary offices.

William C. King has been promoted to Director of Market Research and Economic Analysis for Gulf Oil Corporation, Pittsburgh, Pennsylvania. He had previously been a Chemical Engineer.

John E. Kingsmore is now Estimator with Catalytic Construction Company, Philadelphia, Pennsylvania; he was formerly with T. S. Johnson Sons Incorporated of the same city.

David G. J. Lee, who was formerly associated with Catalytic Construction of Canada, is presently affiliated with Canadian Bechtel Limited, Toronto, Ontario, Canada.

Regional Section Directory

If you reside near one of the regional sections, contact the secretary so that you can benefit from the worthwhile activities of your region. If a business trip coincides with a meeting of a section outside your region, you are welcome to participate in any and all activities.

CHICAGO — MIDWEST

Chairman — William W. Twaddle, Amoco Chemicals Corp., 910 South Michigan Avenue, Chicago 5, Illinois.

Secretary — Daniel T. Brink, Corn Products Co., 201 North Wells, Chicago 6, Illinois.

DELAWARE VALLEY

President — Marion W. Rodgers, E. I. duPont de Nemours & Co., Wilmington 98, Delaware.

Secretary — Anthony J. Gaeto, Pottstown Metal Products Div. of Cochrane Corp., P. O. Box 269, Pottstown, Pennsylvania.

GULF COAST

Chairman — John E. Haselbarth, Pritchard & Abbott Engineers, 2530 West Holcombe Boulevard, Houston 25, Texas.

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